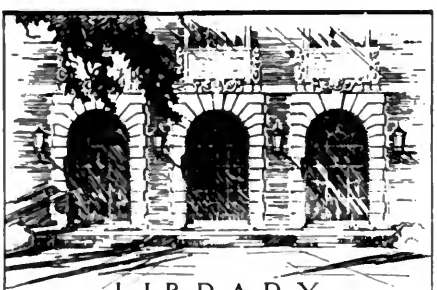

AGRICULTURE

Insect Infestation of Corn Roots in Illinois

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SUBTERRANEAN PORTIONS of corn plants have been attacked by over a dozen species or taxonomic groups of insects since commercial production of corn began in Illinois. However, prior to 1953, there was little quantitative data to indicate the abundance of any single species or groups of species, or to explain the relationship between insect infestation and crop rotation. In 1953, a study was begun to determine the incidence of infestation by those insects which attack either the seed, the roots, or the underground portion of the stalk. Population density studies for these insects were made for the period 1954 through 1963 as a byproduct of a more intensive study of insect control.

Although some 15 insect species or groups were found to damage the seed, roots, or stalk of corn below ground level, it was feasible to study only 6 groups — wireworms, white grubs, the cornfield ant, the corn-root aphid, rootworms, and the grape colaspis.

INSECTS DISCUSSED

The six insects studied occur most commonly on the roots after the seedling stage. In three cases the insects are considered to be members of a taxonomic group. The term "wireworm" includes all species of two genera, *Melanotus* and *Conoderus,* species of *Melanotus* being far more abundant. "White grub" includes species of two genera, *Phyllophaga* and *Cyclocephala; Phyllophaga* were more abundant. Two species of rootworms, northern corn rootworm, *Diabrotica longicornis* (Say), which predominated, and southern corn rootworm, *Diabrotica undecimpunctata howardi* Barber, are grouped together. The grape colaspis, *Colaspis flavida* (Say), the cornfield ant, *Lasius alienus* (Förster), and the corn-root aphid, *Anuraphis maidiradicis* (Forbes) are recorded as species. The last two are recorded as numbers of nests or colonies respectively. In all cases, field identifications of each group or species were verified by examination of typical specimens by a taxonomist.

At least three species which occur on the seeds and seedling plants are not included in these records. They are the seed-corn maggot, *Hylemya cilicrura* (Rondani), the seed-corn beetle, *Agonoderus lecontei* Chaudoir, and the black cutworm, *Agrotis ipsilon* (Hufnagel). These occurred for a very short period during the season, and it was possible

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to secure only a few records where the insect could be clearly identified.

METHODS OF STUDY

Study fields were located throughout the length and breadth of Illinois. However, the majority of the fields were located in the northern two-thirds of the state. The fields used were those where farmers were trying to prevent insect damage by using soil insecticides. All counts included here are from untreated portions of the fields.

Insect presence was determined by digging hills or plants and examining the roots and surrounding soil. At the beginning of the study, a unit for examination was a five-hill sample. Since there were changes in the planting practices of Illinois farmers during the 10-year period, this unit was of necessity changed to a five-plant sample. These counts are recorded in the tables as "plants dug."

FIELD SELECTION

During the first 9 years of this study, no attempt was made to select fields. Usually cooperators were located by happenstance and were asked to leave a portion of the field untreated for comparison. In 1963, however, many of the farmers selected were those who had used insecticides for several years. This history of the use of aldrin or heptachlor is reflected in the lower incidence of infestation for that year.

On the average, 79 percent of the 452 fields studied during this 10-year period were infested by one or more insects (Table 1). In 9 of

Table 1. — Frequency of Infestations in 452 Illinois Corn Fields by any of Six Insects Commonly Attacking Underground Portions of the Plants After the Seedling Stage

Year	Number of fields where plants were dug	Percent of fields infested	Number of plants dug[a]	Percent of plants infested[a]
1954	58	78	355	43
1955	72	89	435	45
1956	36	83	255	50
1957	35	83	215	40
1958	29	83	190	46
1959	47	79	285	60
1960	47	70	255	50
1961	60	77	375	50
1962	42	81	260	48
1963	26	58	135	27
10 years	452	79	2,760	47

[a] In areas where no insecticide had been applied during the current year.

Table 2. — Infestation in 452 Illinois Fields, by Six Insects Commonly Attacking Underground Portions of Corn Plants After the Seedling Stage, Frequency by Fields and by Plants[a]

Year	Number dug	Wireworms[b, c]	Cornfield ant[d]	Corn-root aphid[d]	Rootworms[b]	White grubs[b]	Grape colaspis
				(Percent of fields infested)			
1954	58	59	16	9	12	41	16
1955	72	69	39	21	17	28	8
1956	36	39	53	33	31	50	0
1957	35	51	40	23	31	17	6
1958	29	52	45	34	28	21	7
1959	47	49	51	32	32	17	21
1960	47	45	40	28	43	15	15
1961	60	48	35	33	37	13	7
1962	42	67	74	62	26	10	12
1963	26	31	19	12	35	8	8
10 years	452	53	40	28	28	23	10
				(Percent of plants infested)			
1954	355	27	5	3	14	12	5
1955	435	23	11	5	11	13	1
1956	255	11	22	10	18	20	0
1957	215	19	11	4	15	4	2
1958	190	22	11	7	16	4	3
1959	285	18	20	14	27	4	13
1960	255	18	17	9	24	5	10
1961	375	19	12	13	26	3	3
1962	260	25	22	17	14	1	3
1963	135	12	7	4	11	1	3
10 years	2,760	20	14	9	18	7	4

[a] In areas where no insecticide had been applied during the current year.
[b] Taxonomic groups may include several species found here under one category (see text).
[c] Wireworms also attack seeds and seedlings.
[d] Nests or colonies.

Table 3. — Percent of Fields Infested After Seedling Stage by Stated Number of Insects of any Species, 446 Fields

	Total number fields	Percent of fields not infested	Percent of fields infested by stated number of insects by species or taxonomic groups[a]					Percent infested by more than one insect
			1	2	3	4	5 or 6	
Corn following								
Grass	19	21	11	21	21	21	5	68
Clover[b]	82	15	21	28	23	11	2	65
Alfalfa[b]	35	23	29	23	11	14	0	49
Soybeans	46	22	43	22	7	2	4	35
Small grain	26	38	31	8	12	8	4	31
Total first-year corn	208	21	27	23	16	10	3	51
Second-year corn	132	22	20	27	20	11	1	58
Third-year corn (or more)	106	20	20	21	22	13	5	60
Total all fields	446	21	24	23	18	11	3	55

[a] Taxonomic groups may include several species included here as one category, specifically such groups as "wireworms," "white grubs," "rootworms" (see text).

[b] Includes mixtures and catch crop plantings.

Table 4. — Percent of Fields Infested After Seedling Stage by Certain Insects or Taxonomic Groups, 446 Fields

	Total number fields	Percent of fields not infested	Percent of fields infested by					
			Wireworms[a]	Cornfield ant[b]	Corn-root aphid[b]	Corn rootworms[a]	White grubs[a]	Grape colaspis
Corn following								
Grass	19	21	63	63	47	5	32	16
Clover[c]	82	15	68	43	22	12	26	30
Alfalfa[c]	35	23	69	29	23	9	26	14
Soybeans	46	22	46	20	13	4	39	11
Small grain	26	38	46	27	15	15	27	0
Total first-year corn	208	21	60	35	22	10	29	18
Second-year corn	132	22	48	50	37	23	17	3
Third-year corn	106	20	43	41	32	69	18	6
Total all fields	446	21	52	41	29	28	23	11

[a] Taxonomic groups.
[b] Nests or colonies.
[c] Includes mixtures and catch crop plantings.

the 10 years the percent of fields infested was roughly comparable. The reason for the low infestation in 1963 has been explained. The percent of plants infested compares favorably with the percent of fields infested. Over this 10-year period, 47 percent of the 2,760 plants examined from the 452 fields were being fed upon by one or more insects.

Only one insect species was present in some fields but in 55 percent of the fields a combination of two or more species were usually found. The most common species were two genera of wireworms (as shown in Table 2); 53 percent of the 452 fields examined in this 10-year study were being attacked by wireworms. Cornfield ants, the symbionts of the corn-root aphids, were present in 40 percent of the fields, while the aphids were found in only 28 percent of the fields. Rootworms, both northern and southern, were found in 28 percent of the fields; white grubs in 23 percent; and the grape colaspis in 10 percent of the fields.

Considering the percent of plants infested, wireworms were attacking 20 percent, or one of every five plants examined. Rootworms were found on the roots of 18 percent of the plants; the cornfield ant on 14 percent; the corn-root aphid on 9 percent; white grubs on 7 percent; and the grape colaspis on 4 percent of the plants.

Of the 452 fields in this study, the previous history of 446 is known. When all fields, regardless of rotation, are considered, 55 percent of them were being attacked by two or more insect species, which emphasizes the importance of the entire insect complex found in Illinois cornfields (Table 3). Equally important is the fact that 21 percent of the fields were uninfested. In fields growing corn for three or more years successively, 60 percent of them were infested by two or more insects; 58 percent of the second-year corn fields, and 51 percent of the first-year corn fields were infested by two or more insects. In fields of first-year corn infested by two or more insects, fields where corn follows grass and clover are more subject to attack than other fields.

By compiling the data by insect and by rotation, the relationship between infestation and rotation can be determined (Table 4). During the 10-year period, it was found that wireworms are most likely to be important as a pest of corn following grass, clover, or alfalfa. Cornfield ants and corn-root aphids are most likely to appear on corn following grasses; there is a tendency for white grubs to be more prevalent on corn following soybeans or grass; rootworms are more important on corn grown for three or more years in succession in the same field; and the grape colaspis is noticeably more abundant on corn following clover.

CONCLUSIONS

It is clear that in Illinois it is necessary to reckon with the entire insect complex attacking the underground portions of corn plants rather than with any one species. In determining the need for control of insects attacking first-year corn in a rotation, it is indicated that the greatest consideration should be given to corn grown following grasses, and corn grown for more than one year in the same field.

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